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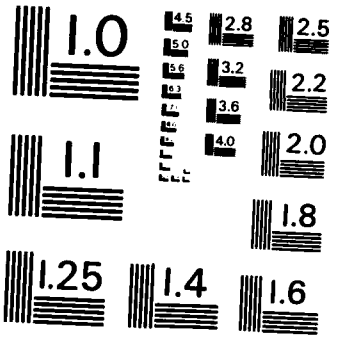


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# DISTRICT AND SCHOOL INCENTIVES FOR TEACHERS' INSTRUCTIONAL USES OF MICROCOMPUTERS

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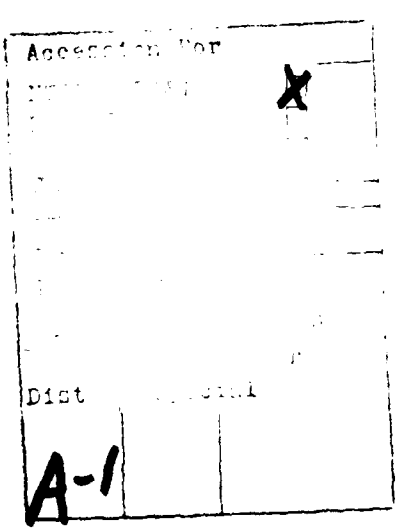


The microcomputer has become an important educational innovation, and the number of computers available for instruction in public schools is increasing dramatically (NCES, 1982). However, the number of teachers with training and knowledge to use computers effectively for instruction is lagging (Isaacson, 1981; OTA, 1982), and consequently, beneficial uses of the technology are far from realized (NEA, 1983). There is widespread recognition that to optimize computer use in classrooms, many teachers will need some form of encouragement (Shavelson et al., 1984; U. S. Department of Education Task Force, 1981).

A key factor that may encourage more widespread use of microcomputers in classroom instruction is teacher incentives. Various types of incentives have been proposed to stimulate teachers' involvement with computers. For example, organizational incentives such as support for training or providing various forms of technical assistance (Sheingold et al., 1981), may help encourage the implementation of microcomputers into classroom instruction. Likewise, other incentives, such as loaning computers to teachers over weekends, vacations, and summers (Sherman, 1983), or subsidizing teachers to author courseware (OTA, 1982), may increase teachers' proficiency with computers.

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Unfortunately, research that systematically examines which incentives (or combinations of them) are most effective in stimulating instructional microcomputer use has not been conducted. We report such research in this paper, addressing three related questions: (1) What can districts and schools do to encourage teachers to gain proficiency and use microcomputers in their teaching? (2) How do teachers' microcomputer-based teaching practices respond to the actions of districts and schools? and (3) Which district and school activities have the greatest incentive value for each of these outcomes?

## CONCEPTUAL FRAMEWORK

We examined these issues as part of a study entitled "Effective Incentives for Teachers' Instructional Use of Computers." The purpose of this study, sponsored by the National Institute of Education and in its final stages, is to examine how different *types of incentives and forms of support* influence how *microcomputers are used for classroom instruction* and the role that *staff development* plays in this process.

We focus largely on the first issue in this paper. (The second issue is examined in Winkler and Stasz, 1985). Our conceptual framework identifies three areas of concern. The first relates to the types of incentives and forms of support that may encourage teachers to use microcomputers for classroom instruction. The research literature suggests that the manner in which districts and schools implement innovative programs, support them, and solicit teacher participation may lead to widely different instructional outcomes. A review of the literature and our previous research experience (Shavelson et al., 1984) identified various district and school support policies that may

influence teachers' use of microcomputers for instruction. These include the provision of such things as: fiscal support; technical assistance with equipment, educational courseware, and curriculum; and organizational commitment and leadership (e.g., from building staff). Administrations may also involve teachers in the implementation efforts, and they may provide teachers with rewards such as salary credit, release time, or professional recognition.

Each of these administrative policies may have differing *incentive value* for teachers. Some administrative policies, such as the simple provision of technical support to computer-using teachers, may act in important ways to encourage classroom computer use. Similarly, we might hypothesize that providing organizational commitment in the form of written goals or fiscal support would encourage computer use. Other policies may encourage computer use in more subtle ways. For example, we hypothesized that "intrinsic" rewards such as professional recognition might motivate wider classroom use of computers than would "extrinsic" rewards such as salary credit. All of these activities may have beneficial outcomes, but their actual effects and their relative importance have not been empirically examined.

A related issue concerns the nature of "improved" classroom instructional computer use stimulated by incentives (the outcome variable). We use a theoretical perspective that characterizes "pedagogically sound" classroom computer use (Winkler et al., in press). Our perspective assumes that as computer use becomes *integrated* into ongoing instruction, more effective and higher quality teaching practices with computers result. Integration may be indicated by increased *student time* with computers or by using the computer for

increased *pedagogical activities* or to meet a wide variety of student *objectives*.

A final issue concerns the characteristics of teachers and the instructional environment that may delimit the effects of incentives and support. Again our previous research suggests that differences among teachers (i.e., demographic and experiential) and students served (e.g., grade level, subject matter, student characteristics) may bound the effects of various administrative support policies in important ways.

## METHODS AND DATA SOURCES

### Sample

We examined these issues initially through secondary analyses of data collected during our earlier study (Shavelson, et al, 1984). The purpose of the earlier study was to describe how teachers believed to be "successful" microcomputer users used computers for instruction of mathematics or science at the elementary and secondary levels. Teachers were located through a "snowball" procedure that solicited nominations of microcomputer-using teachers from experts in education and government, administrators of educational computing organizations, and district, school, and teacher contacts. Teachers so nominated were invited to participate in the study if they fulfilled the minimal criteria that they currently used microcomputers as part of regular classroom instruction in mathematics or science and were responsible for determining the content and form of the microcomputer-based learning activities. Sixty-five teachers participated in the study.

## Data Collection Procedures

Data was collected during the 1982-83 school year in the State of California. The study was field-based and naturalistic, employing both qualitative and quantitative techniques. The primary method of data collection was open-ended interviews; data from teacher interviews were subsequently coded onto questionnaires by field interviewers. (This procedure provides extensive quantitative data from interviewers' field notes. Additionally, the questionnaire provided data that could be used to estimate inter-interviewer reliability.) Interviews largely focused on teaching practices using microcomputers and lasted approximately one hour.

These interviews were augmented with other methods of data collection. We also observed how teachers used microcomputers in their classroom or laboratory. Typically, the observation period lasted about 50 minutes. We noted the physical context of microcomputer use (e.g., the number, type, and location of available equipment) and examined the courseware used during the observation period. Finally, we obtained biographical data from teachers through a self-administered questionnaire. This provided information on their educational and teaching background, and their experiences with and attitudes toward computers.

Along with each teacher, we interviewed an administrator knowledgeable about instructional computer use in the district, and we interviewed the principal of the teacher's school. Among other things, these interviews solicited information on district and school practices for supporting instructional microcomputer use, covering such topics as

how microcomputers were implemented in the district, levels and forms of funding for microcomputer hardware and software, support services provided to microcomputer-using teachers, rewards and encouragement for microcomputer use provided by the district and school, and staff development opportunities. These interviews also lasted approximately one hour, and again, field staff formalized their interview notes onto a largely closed-ended protocol. Together, these data sources provided the needed information for describing different types of incentives and rewards and linking these with instructional microcomputer use, characteristics of teachers, and the students served.

## RESULTS

### Characteristics of the Sample

The final sample upon which the following analyses are based consisted of 65 teachers in 49 schools and 25 districts. Two-thirds of the teachers taught sixth grade or lower; slightly over three-fourths used microcomputers for instruction in mathematics. (The remainder used microcomputers for instruction in science). Our respondents' teaching experience ranged from 2 to 38 years with an average of nearly 16 years. On average, mathematics accounted for about seventeen percent of teachers' undergraduate coursework, while science courses accounted for 28 percent of undergraduate coursework. Fifty-two percent of the teachers in the sample were female.

Overall, teachers indicated that their students were about average in ability (mean=2.1 on a 3-point scale) but the ability composition of individual classrooms varied from low to high. On average, classrooms were comprised of 38 percent minority, but percent minority varied greatly (i.e., ranging from 0 to 98 percent). Less variable was the

gender composition of the classrooms, in which male students comprised 54 percent on average.

## Administrative Policies Supporting Microcomputer Use

We found a great deal of variation within our sample with respect to administrative policies supporting microcomputer use. As discussed above, we distinguished various administrative policies with potential incentive value for encouraging classroom microcomputer use. In addition to incentives and rewards as customarily conceived, these included technical assistance, fiscal support, organizational commitment, and teacher participation in implementation.

*Technical Support*. The accessibility of hardware, courseware, and technical support is fundamentally important to how microcomputers will be used. We found that different levels of technical support were available to our sample of teachers. The median number of microcomputers available for teachers' use was two, but the number available ranged from 1 to 24. Eighty-six percent of the teachers had their microcomputers located in their classroom, and forty-four percent had these micros available to them on a daily basis. As far as assistance in using this hardware was concerned, 47 percent could receive assistance from the district with maintaining computer hardware, and 64 percent could receive assistance in locating courseware for use in their class. Indeed, most teachers (88 percent) obtained some courseware through the district, but over one-fourth had five or less diskettes containing different instructional programs. In addition, 29 percent could receive curricular assistance "integrating" computers into their regular classroom instruction; for 62 percent, a resource person was available in the school. Support was also indicated in the form of

staff development: 90 percent of the sample could receive some form of inservice microcomputer training through the district; 34 percent had computer staff development available in their schools.

*Incentives and Rewards for Teachers.* Incentives and rewards as customarily conceived are believed to motivate interest and learning in novel task situations. The literature commonly distinguishes between extrinsic rewards such as salary credit and intrinsic rewards such as professional recognition (e.g., Griffin, 1983). Unfortunately, financial rewards are scarce in today's educational environment. Financial incentives were found in the form of promotions or salary credits for about one-third of the teachers, while 13 percent could receive remuneration for computer-related courses taken outside the district. Incentives that may be presumed to appeal to more "intrinsic" interests were more varied and prevalent. Forty-eight percent could receive release time for computer-related activities. While 54 percent had access to a microcomputer in the school for experimentation and self-learning, only 18 percent had take-home privileges. Eighteen percent also could receive some informal "special recognition" from their administrations for microcomputer use.

*Teacher Involvement, Organizational Commitment, and Fiscal Policies.* We briefly mention these remaining policies with possible incentive value for teachers, because they did not generally prove to influence how microcomputers were used for instruction despite considerable variation in our sample. Although the literature on implementation of innovations suggests that teacher involvement in decisionmaking and in the implementation process leads to more positive outcomes, teacher involvement in implementation and decisions regarding

hardware, courseware, and staff development at the district or school level did not affect how computers were used for instruction (with one exception discussed below). Similarly, though organizational commitment is believed to be important for implementation of an innovation like the computer to be successful, we found no effect on teaching practices, at least as indicated by the presence of written objectives at the district or school levels regarding computers and their uses. Finally, how microcomputers were funded--as a district "line-item," through entitled programs, or with discretionary and outside funds-- did not affect how computers were used by teachers.

## Effects of Incentives and Support on Teaching Practices

The major goal of our analysis was to determine the relative influence of these incentives and forms of support in heightening the integration of microcomputers in classroom instruction. Indicators of integration include: a global measure of integration of microcomputer activities into "regular" instruction (provided by each teacher on a four-point scale from "not at all" to "extremely"); the number of minutes per week students spend working with a microcomputer; and the number of different kinds of computer-based learning activities used in the class (e.g., drill-and-practice, tutorial, simulation, and discovery learning programs). We also have some preliminary findings regarding teachers' participation in staff development when available in their districts and schools.

The major analytic tool used in these analyses was multiple regression analysis. Initial correlations--confirmed by the regression analyses--told a consistent story: adequate technical support is far and away the most important determinant of increased integration of

microcomputers into "regular" instruction for the math and science teachers in our sample. Our global measure showed that greater integration was seen when larger numbers of microcomputers were available to teachers and when these microcomputers were configured in a laboratory setting. The availability of technical assistance from the district for maintaining hardware and locating and evaluating courseware also proved to be significantly predictive. Incentives as customarily conceived and traditionally dispensed by districts and schools were unrelated to this measure of integration.

We also found that increased numbers of microcomputers of more frequent accessibility were the best and most important predictors of how much time a student spent working with a microcomputer. More student time was found with less complex microcomputer configurations, however. Again, we found that the "conventional" incentives and rewards were unrelated to student microcomputer time.

Finally, teachers employed a greater variety of microcomputer-based learning activities with more complex hardware configurations (i.e., more disk drives per computer). Of greater importance here were several other forms of technical support. A wider variety of learning activities were found when courseware was purchased for teachers by the district and when the district provided teachers with technical assistance in locating and evaluating courseware. In addition, more varied microcomputer use was found when the teacher had a voice in selecting courseware for acquisition by the district. At the school level, variety also increased when a computer resource person was available. The narrower incentives and rewards made no positive contribution here as well.

*Staff Development and Incentives.* To a limited extent, we were able to examine how incentives affect teachers' participation in staff development activities in this phase of the research (for further research on this issue, see Winkler and Stasz, 1985). These findings should be interpreted with caution, as 80 percent of the teachers participated in district or school inservice as student or as trainer. Caveat in mind, our preliminary findings suggest that policies and incentives other than technical support play an influential role in stimulating teacher participation in district or school computer staff development. "Intrinsic" incentives, such as a computer set aside for teacher experimentation, as well as "extrinsic" incentives, such as the possibility of a promotion and a pay raise, appear to stimulate teacher participation. Technical support in the form of district-purchased courseware is important, and participation also increases when teachers are involved in selection of courseware for acquisition and in district computer implementation. Indeed, when teachers are *not* involved in computer implementation or decisions regarding courseware and staff development, our evidence indicates that teachers may bypass or supplement the district or school offerings and take classes on their own outside.

*Delimiting Effects of Support and Incentives.* Given that the relationships between incentives and teacher practices and staff development exist within a particular context, our final analysis examined whether characteristics of teachers and the instructional environment moderated the findings discussed above. In general, we found few significant relationships between teacher and student

variables with support and incentives, on the one hand, and with teaching practices, on the other.

One variable that seemed to matter was the minority status of students served. Districts are more likely to provide curricular assistance to teachers in classes where we observed a smaller percentage of minority students. Staff development is also more likely to be provided when there is a lower percentage of minority students. In turn, a higher degree of integration was seen in these classes. An additional finding was that classes with fewer students received more computer time and a wider variety of instructional material. Teacher characteristics were generally unrelated to teaching practices, except for the fact that male teachers have more microcomputers and their students receive more time at the computer.

## CONCLUSIONS AND IMPLICATIONS

These findings strongly suggest that administrative technical support is the most important incentive for heightening the integration of microcomputers into regular math and science instruction. Providing teachers with an adequate amount of microcomputer hardware and courseware, making it readily accessible for instructional use, and offering assistance, especially with courseware and curriculum, increases significantly the degree of integration. Not only is technical support influential in its own right, the regression analyses clearly show that it is far more important than any of the other support mechanisms or incentives we examined. Indeed, the failure of the "traditional" incentives to account for variance in instructional computer use is surprising and reinforces these findings.

These results imply that the best way for districts and schools to foster improved microcomputer use in classroom instruction is to continue to build their stock of microcomputer hardware and courseware. The importance of microcomputer availability and accessibility may not be especially surprising. On the other hand, the importance of centralized technical assistance for teachers may not yet be widely recognized. Teachers appear to benefit greatly when districts provide them with assistance in the important area of *courseware*--locating, evaluating and acquiring it, and helping teachers decide how to use it in their teaching.

Findings relating support and incentives to staff development participation are also suggestive. Whereas technical support proved most important for heightening the integration of microcomputers into regular math and science instruction, other incentives appear to play a more important role regarding staff development. Together, these results may suggest that incentives play a role in stimulating teachers' computer training, but that broader support mechanisms determine how microcomputers will be used subsequently for instruction.

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